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# **Bering Strait: A Vital and Variable Forcing of the Western Arctic Shelves, Slopes, and Basins**

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## **LONG-TERM GOALS**

Our long-term research goals are to understand the physics of the high-latitude ocean mechanistically and quantitatively with respect to both its structure and circulation, as well as to understand the links between those physical mechanisms and the biology and chemistry of the high-latitude marine environment. The variability of the marine environment is a special focus and concern.

## **OBJECTIVES**

Our objective in this work is to measure directly the variable inflow to the Arctic Ocean through Bering Strait of waters from the North Pacific, together with the varying properties of those waters. This influx of Pacific waters provides a key forcing for the Western Arctic shelf-slope-basin system, and the Pacific influence can be traced across the Arctic Ocean into the northern North Atlantic. A particularly important dynamical aspect of the Pacific presence in the Arctic Ocean is its contribution to stabilizing the upper ocean, and thereby its influence on the maintenance of the ice cover and on upper ocean mixing.

## **APPROACH**

Our approach is to deploy two instrumented moorings in Bering Strait during each of the years 1999-2001. In conjunction with earlier measurements, this will provide near-continuity in the record of flow and water properties in the strait over a decade. Velocity, temperature, and salinity are the core physical measurements at each mooring, supplemented with ice thickness measurements using upward-looking sonar (cf., the related project section). Both moorings will be recovered after the first year and two new ones deployed. The two channels of Bering Strait are both being monitored, the eastern one at a mid-channel site and the western one at a location north of the Diomed Islands, just outside the Russian Exclusive Economic Zone.

## **WORK COMPLETED**

Both moorings were successfully deployed at their intended positions during July 1999 from the Canadian ice breaker *CCGS Sir Wilfrid Laurier*. During that cruise and a subsequent one onboard the *R/V Alpha Helix*, we also recovered two moorings deployed the previous year under NOAA sponsorship. These records will be combined with earlier ones to provide a long-term perspective on the present ONR-sponsored effort.

## RESULTS

No data will be available from the present effort until late summer 2000, when the first year moorings are scheduled for recovery.

## IMPACT/APPLICATIONS

We expect the clarification of salinity trends in the North Pacific to be manifested in the Bering Strait measurements, with resulting insights into both the northern hemisphere evaporation-precipitation balance and the consequences of these trends for the stratification of the upper Arctic Ocean. In general we also look for moorings in the high-latitude ice-covered ocean to increasingly incorporate new and novel instrumentation. The first year of the present effort represents a step in this direction (cf., the related project section), and we think it likely that the second year of deployments in Bering Strait will incorporate one or more additional instruments of this kind.

## TRANSITIONS

The time series measurements from Bering Strait will be used in a variety of physical and biochemical studies on the western Arctic shelves, including:

- 1) The flux and processing of freshwater on the Western Arctic shelves;
- 2) The variability of Western Arctic shelf sources for the interior ocean and the causes of that variability; and
- 3) The needs of a variety of Arctic simulations for accurate long-term boundary conditions and forcing.

## RELATED PROJECTS

Several related projects are presently under way, and we anticipate additional ones during the second year. The first of the related efforts is deployment of an automated *in situ* water sampler on the mooring in the western channel of the strait. This work is being done by K. Falkner at Oregon State University, and it is a prototype of the new generation of time series measurements that will be required to illuminate biogeochemical cycles in the high-latitude ocean. The second related effort is the incorporation of upward-looking sonar on both moorings, under the direction of R. Moritz at the University of Washington. This addresses the need for circumpolar time series measurements of ice thickness, both to illuminate issues of ice mechanics and thermodynamics, and to ascertain the extent of the recent dramatic decreases of ice thickness observed within the Arctic Ocean by submarines. We anticipate a third related project the second year, viz., the addition of an *in situ* nutrient sensor to the western channel mooring under the supervision of T. Whitledge of the University of Alaska.